LAWRENCE LIVERMORE
REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory, Aug. 16-20, 2010

Diamond is one tough, 'weird' cookie

Time-integrated photograph of an OMEGA laser shot to measure high-pressure diamond strength.

Popular Mechanics recently issued its report on the top 10 weird science stories of 2010 and LLNL research made the list.

Just exactly how tough is diamond? To figure it out, two teams of physicists blasted samples of the gem with powerful lasers to determine exactly how diamonds react in extreme environments. They used the Janus laser at Lawrence Livermore and the Omega laser at the University of Rochester.

The lasers created shock waves of pressure 40 million times the Earth's atmospheric pressure, melting the diamonds. The researchers then tweaked the lasers to gradually decrease the temperature and pressure to see when solid diamond would re-form.

To read more, go to http://www.popularmechanics.com/technology/engineering/news/top-weird-science-stories-of-2010?click=pm_news

LLNL code helps lead way to 'zero fatalities' car

A Honda engineer uses LS-Dyna software to simulate a crash test. Image by American Honda Motor Co.

Future cars may include features such as zero fatalities. In other words, crash simulations and other safety devices have helped the cars move closer to a zero fatality rate.

A computer code originally developed at the Laboratory, called Dyna 3D, is one of two leading software tools for simulating complex crash environments. GM uses the Dyna code, now owned by Livermore Software Technology Corp., to run its crash simulation tests.

With such detailed simulation and analysis, it's not surprising that processing power is an important factor. For many common computer simulations, such as one vehicle crashing into another, carmakers have the supercomputing power they need in-house. For example, American Honda Motor Co. (which includes Honda and Acura cars, Honda motorcycles, motors and power equipment) has more than 3,000 processors dedicated to crash analyses.

To read more, go to
http://www.computerworld.com/s/article/9179697/Car_tech_Building_the_zero_fatality_car

Supernova's spin on life

This artist's concept shows the material around a recently exploded star, known as Supernova 1987A.

A supernova is the cataclysmic death of a star. But from a star's death may come life on Earth.

New Lab research suggests that life's building blocks were created not on Earth, but elsewhere in the cosmos.

Many of these building blocks, such as amino acids, sugars and other molecules, are chiral — they come in two identical forms that are mirror opposites. In chemistry, chirality refers to asymmetrical molecules that also cannot be superimposed on each other. They are considered right- or left-handed depending on how their atoms are arranged.

On Earth, life tends to be left-handed. Left-handedness also seems to prevail throughout the cosmos, according to studies of meteorites, and Lab researchers believe supernovae are the reason.

Lab nuclear astrophysicist Richard Boyd and his colleagues suggest these particles, ejected when a star collapses, would interact with right-handed nitrogen atoms inside amino acid molecules.

To read more, go to http://www.popsci.com/science/article/2010-08/supernovae-might-be-directing-lifes-development-throughout-universe

A 'rad' model for detection

The Laboratory and and ICx Technololgies Inc. of Arlington, Va., have partnered to develop Statistical Radiation Detection System (SRaDS) to meet the requirements for fast, accurate detection and identification of radioactive materials.

The developers looked to overcome low observable count rates, short detection intervals, background noise, measurement system inadequacies, and heterogeneous transport paths between the source and detector.

SRaDS uses all information available in every photon upon arrival, something ignored by traditional spectroscopy.

To read more, go to http://www.rdmag.com/Awards/Rd-100-Awards/2010/08/A-New-Model-For-Radionuclide-Detection/

Mining for missing matter

A mine shaft in Minnesota serves as the entry to the Soudan Underground Laboratory.

The invisible, ubiquitous substance known as dark matter is hard to find, even though it makes up more than 80 percent of the universe's mass.

Lab researchers and colleagues nationwide are going deep underground in a Minnesota mine to look for it. The mineshaft serves as the entry to the Soudan Underground Laboratory, one of the key sites in the search for the mysterious dark matter.

Dark matter must exist, astronomers say, because the cosmic allotment of ordinary, visible matter doesn't provide enough gravitational glue to hold galaxies together. Although the missing material shouldn't be any more prevalent in the underworld than above ground, dark matter hunters have good reason to frequent Soudan and other subterranean areas.

Because dark matter particles would interact so weakly, experiments designed to detect the dark stuff could easily be overwhelmed by other particles. So scientists at Soudan and elsewhere use Earth's crust to filter out cosmic rays -- charged particles from space that bombard Earth's atmosphere.

To read more about the search for dark matter, go to

http://www.sciencenews.org/view/feature/id/62062/title/Mining_for_missing_matter

Latest Newsline available

Newsline provides the latest Lab research and operations news. See the most recent issue at

https://newsline.llnl.gov

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

To send input to the Livermore Lab Report, send e-mail mailto:labreport@llnl.gov.

The *Livermore Lab Report* archive is available at:
https://publicaffairs.llnl.gov/news/lab_report/2010index.html